

Respiratory Ailments of Stone Crusher Workers in Bundelkhand Region of Uttar Pradesh

Mahendra Kumarupadhyay¹, Surya Kant Chaturvedi²

Department of Biological Sciences, Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot – Satna, M. P. India

Abstract: The study was carried out among stone crusher workers and nearby residents to assess the respiratory ailments occurring due to exposure of silica dust. Stone crusher impact zones are covered with Granite, Silica sand and Morrums. The various crushing operations involved in stone crushing e.g. blasting, manual cutting, crushing and transportation emit fugitive stone dust. These fine aerosol of stone dust causes health problems among the stone crusher workers. Sputum examination, Spirometry (Pulmonary function test) and Radiology was carried out to assess the prevalence of tuberculosis and other occupational diseases.

Keywords: Tuberculosis, FVC, FEV1, Radiology

1. Introduction

Stone crushing in India is a labour intensive industry engaged in crushing mined stone into gravels of different sizes, which are used as construction of roads, buildings, dams etc. In Chitrakoot (Bharatkoop), Banda, Mahoba (Kabrai) and most of the Bundelkhand region of Uttar Pradesh, India granite mining is one of the main economic activities that engaged many people both man and women. The various unit operations involved in stone crushing e.g. drilling, blasting, crushing, screening, loading, unloading and transportation emit process and fugitive dust. These substantial fugitive dust emissions pollute the ambient air quality and surrounding environment. The fine silica dust is highly hazardous to human health, agriculture and adversely affects visibility in the nearby areas. According to Occupational Knowledge International (OK International), Silica released from stone crushing is causing an epidemic of silicosis, cancer, other lung diseases and increases the risk of acquiring Tuberculosis (TB). This situation is particularly dire in India where the stone crushing industry employs over half a million people, many of whom are women and children. Ravindra (1991), Ghose (1989) and NIOSH (2002); occupational exposure to respirable crystalline silica is a serious but preventable health hazard. The objective of the study was to study the respiratory ailments occurring due to exposure to silica dust.

Tuberculosis is a communicable disease highly prevalent in India, does particularly afflict the working populations in dusty industries. In Stone crushing occupations the peoples are in a greater level of exposure to silica dust so that they are susceptible to TB. Spirometric measurements (Pulmonary Function Test) and Chest Radiographs presents evidences of respiratory impairments and infections in lungs. The long term exposure of workers to silica dust causes silicosis, the most frequently occurring pneumoconiosis.

2. Materials and Methods

A detailed health impact survey of stone crusher workers and nearby residents at Chitrakoot (Bharatkoop), Banda, Mahoba (Kabrai) was conducted on a questionnaire basis. Health survey e.g. General clinical examination, Tuberculosis (AFB Test), Spirometry (Pulmonary Function

Test), and Radiology was undertaken. Tuberculosis test was done by AFB (Acid Fast Bacillus) Test. Pulmonary Function test was carried out using Spirometer. Radiology (X-ray) of workers was done.

There are near about 41 stone crushers in Chitrakoot, 11 stone crushers in Banda, and more than 150 stone crushers in Mahoba. Most of the stone crushers in these areas have inadequate dust control system so that dust emission is substantial which leads to adverse impact on workers health and as well as surrounding environment. The dust exposure effects on the workers and resultant health hazard are discussed as-

3. Sputum Examination of Stonecrusher Workers

Sputum examination was carried out by AFB (Acid Fast Bacilli) Test to determine Pulmonary Tuberculosis caused by Mycobacterium tuberculosis bacteria. Sputum of Fifty workers (34 male and 16 female) from Chitrakoot (Bharatkoop), Twenty five workers (16 male and 09 female) from Banda and Fifty workers (32 male and 18 female) from Mahoba (Kabrai) was examined. AFB positive and AFB negative results were as follows:

Table 1: Sputum Examination of Stone Crusher Workeres

Study Area	Age Group	Male No. AFB Examined/ No.AFB Positive (%)	Female No. AFB Examined/ No.AFB Positive (%)	Effective No. AFB Examined No. AFB Positive (%)
Chitrakoot (Bharatkoop)	<25	07/00=00	02/00=00	09/00=00
	25-35	10/01=10	05/00=00	15/01=06
	35-45	12/03=25	06/01=16	18/04=22
	>45	05/02=40	03/01=33	08/03=37
Banda	<25	03/00=00	01/00=00	04/00=00
	25-35	04/00=00	03/00=00	07/00=00
	35-45	05/01=20	04/00=00	09/01=11
	>45	04/01=25	01/00=00	05/01=20
Mahoba (Kabrai)	<25	08/01=12	03/00=00	11/01=09
	25-35	10/02=20	06/01=16	16/03=18
	35-45	09/03=33	05/01=20	14/04=28
	>45	05/02=40	04/02=50	09/04=44

4. Spirometry of Stone Crusher Workers

Spirometric measurement (Pulmonary function test) was carried out for measuring lung function volume of stone crusher workers through Spirometer and to analyze the factors affecting them. FVC (Forced expiratory vital capacity) and FEV1 (Forced Expiratory volume during one second) was measured to find out the ratio FEV1/FVC. In

the normal person the ratio is about 80 %.However in airway obstruction this value has decreased to 47 %.In serious airway obstruction this reduces to 20 %.The lung function parameters were measured in relation to age, sex and duration of exposure which are presented in following tables:

Table 2: Lung Function Parameters of Stone Crusher workers according to Age Group

Study area	Age Group	No. of workers	FEV1 (lit.)	FVC (lit)	FEV1/FVC %
Chitrakoot (Bharatkoop)	<25	09	2.28±0.52	3.30±0.20	69-78
	25-35	15	2.30±0.20	3.40±0.18	67-69
	35-40	18	2.10±0.87	3.31±0.98	63-72
	>45	08	1.97±0.99	3.50±0.11	56-63
Banda	<25	04	2.50±0.73	3.35±0.45	74-79
	25-35	07	2.30±0.40	3.40±0.30	67-72
	35-40	09	2.07±0.37	3.03±0.35	68-70
	>45	05	1.93±0.97	3.29±0.20	58-61
Mahoba(Kabrai)	<25	11	2.20±0.73	3.35±0.70	65-73
	25-35	16	2.00±0.30	3.30±0.40	60-67
	35-45	14	1.70±0.97	3.25±0.50	52-56
	>45	09	1.50±0.83	3.20±0.30	46-55

Table 3: Lung Function Parameters Of Stone Crusher Workers: According To Sex Group:

Study area	Sex Group	No. of workers	FEV1 (lit.)	FVC (lit)	FEV1/FVC %
Chitrakoot (Bharatkoop)	M	34	1.97±1.52	3.50±0.20	56-78
	F	16	2.10±0.20	3.31±0.18	63-69
Banda	M	16	1.93±1.73	3.29±0.45	58-79
	F	09	2.07±0.37	3.03±0.35	68-70
Mahoba (Kabrai)	M	32	1.50±1.73	3.20±0.70	46-73
	F	18	1.70±1.30	3.25±0.40	52-67

Table 4: Lung Function Parameters of Stone Crusherworkers: According to Duration of Exposure

Study area	Duration of exposure	No. of workers	FEV1 (lit.)	FVC (lit.)	FEV1/FVC %
Chitrakoot (Bharatkoop)	5-15	31	2.20±0.52	3.18±0.20	69-78
	>15	19	1.97±1.10	3.50±0.31	56-63
Banda	5-15	17	2.37±0.73	3.35±0.45	70-79
	>15	08	1.93±1.07	3.29±0.03	58-68
Mahoba(Kabrai)	5-15	27	2.30±0.73	3.40±0.70	67-73
	>15	23	1.50 ±0.70	3.20± 0.25	46-52

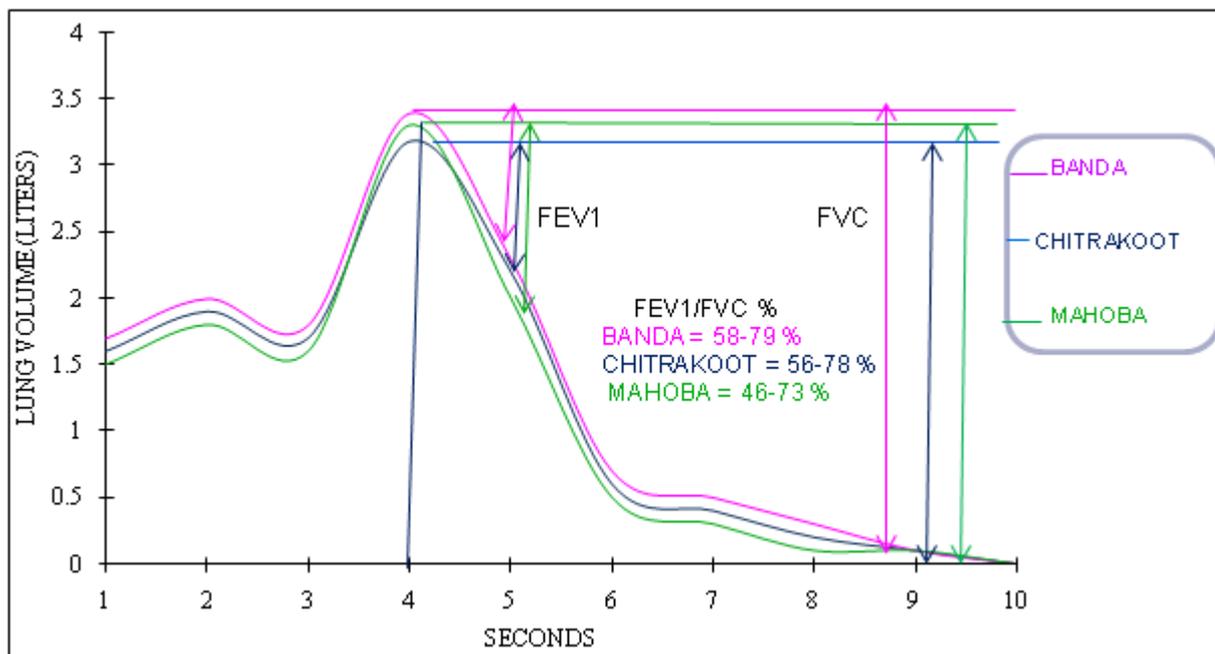


Table 5: Graphical Presentation of Lung Function Parameters of Crusher Workers

Radiology

The chest X-ray of some workers working from more than ten years and was done to find out the effect of silica dust on lungs. The findings are:

Table 6: Radiology (X-Ray) Observation of Crusher Workers

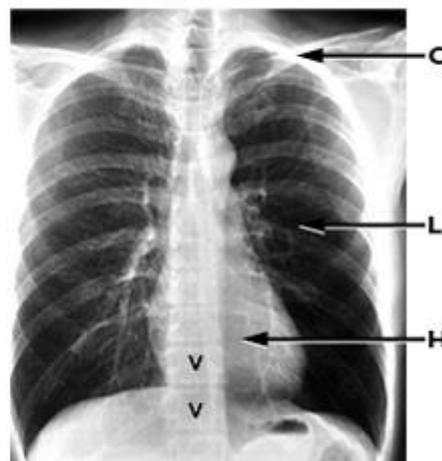
Study area	No. of Workers	Normal Radiological Appear.	Abnormal Radiological Appear.	Abnormal (%) Radiological appear.
Chitrakoot (Bharatkoop)	12	09	03	33
Banda Mahoba (Kabrai)	05	04	01	25
	16	11	05	45

Radiographs of Some Stone Crusher Workers:

Chest X-Ray: Silicosis



Normal X-Ray



Infection in lower lobe



Infection in Upper lobe



5. Result and Discussion

Most of the crusher workers are affected with persistent cough, weight loss, fever, chest pain etc. which is the most common symptom of pulmonary tuberculosis. Table -1 show the distribution of TB cases according to study variables among the stone crushers workers. It can be seen that those age group more than 35 years and those employed for ≥ 5 years had higher prevalence of TB. The workers who were

smokers had higher risk of TB. In Bharatkoop block of Chitrakoot and Kabrai block of Mahoba districts most of the crusher workers are diagnosed with TB, and according to DOTS report the average life span of a worker is 40-50 years. Rajnarayan R. (2007) and Tiwari *et. al.* (2007) study provide higher prevalence of TB on stone crusher workers.

Table-2,3, 4 and 5 shows the distribution of lung function parameters. These tables represent that the workers of older

age group, Female workers and those who are working for more than 15 years have lower FEV1/FVC % than that of normal which is 80 %. Similarly lung function parameter study of Rajnarayan R. *et.al.* (2007), Green D A. *et.al.* (2007), Gangopadhyay P. K. *et.al.* (2008), Gottesfeld P. *et. al.* (2008) and Bahramiet *al.* (2008) found a decrease in pulmonary function among stone crushers.

Radiological study as presented in Table-6 shows 33 % workers in Chitrakoot, 25 % workers in Banda and 40 % workers in Mahoba have abnormal radiology report. Radiological report shows rounded opacities beginning in upper and middle lobe of lung and massive hilum shadowing. The workers which are working for more than 15 years have cavitations, soft nodulations, and fibrosis in their lungs which are seen in their radiographs. Olusegun O. *et. al.* (2009) Gangopadhyay P. K. *et. al.* (2008) study states the presence of pneumoconiosis.

It can therefore be concluded that stone crushing workers who are exposed to approximately 100 % free silica have deteriorated lung function and it can be attributed mainly to respiratory disorders, along with other epidemiological factors such as age, sex, duration of exposure and smoking. The pulmonary function of the workers having tuberculosis was also found to be deteriorated. This deterioration in pulmonary function is only noticed in the advanced stages of the disease when much of the lung tissue is damaged, so that a periodic measurement of lung functions should be done for detecting lung abnormalities in the early stage

References

- [1] Tiwari RR, Sharma YK and Saiyed HN. Tuberculosis among workers exposed to free silica dust. *Indian J. Occup Environ Med* 2007; 11:61-4.
- [2] Ravindra P. (1991). Studies on suspended particulate matter in an Industrial area. *Indian J. Env. Protection.* 11(5), 358-359.
- [3] Bahrami AR, Golbabai F, Mahjub H, Qorbani F, Aliabadi M, and Barqi M. Determination of exposure to respirable quartz in the stone crushing units at Azendarian-west of Iran. *Ind Health* 2008; 46:404-408.
- [4] Green A, McAlpine G, Semple S, Cowie H and Seaton A. Mineral dust exposure in young Indian adults: an effect on lung growth?. *Occup Environ Med* 2007; 65:306-310.
- [5] Gottesfeld P, Nicas M, Kephart J, Balakrishnan K, and Rinehart R. Reduction of Respirable Silica Following the Introduction of Water Spray applications in Indian Stone Crusher Mills. *International Journal of Occupational and Environmental Health*, Vol. 14, No. 2, 2008 pp94-103.
- [6] Gangopadhyay P.K. and Chattopadhyay B.P., 2008. Occupational health problems of stone crusher in West bengal a pilot study at birbhum district.
- [7] NIOSH (2002) Hazard Review, Health Effects of Occupational Exposure to Respirable Crystalline Silica. DHHS -129. pp. 23.
- [8] Tiwari RR, Sharma YK, Saiyed HN. Tuberculosis among workers exposed to free silica dust. *Indian J Occup Environ Med* 2007; 11:61-64.
- [9] Olusegun O, Adeniyi A, Adeola GT. Impact of Granite Quarrying on the Health of Workers and nearby residents

in Abeokuta Ogum State, Nigeria. *Ethiopian J. of Environmental Studies and Management.* Vol.2 No.1 2009.